

## REMARKS

This amendment is submitted in response to the non-final Office Action mailed on December 20, 2004. Claims 1-20 are pending in this application. Claims 2-4, 6-7, 10-16 and 18-19 have been withdrawn previously. In the Office Action, Claims 1, 5, 8-9, 17 and 20 are rejected under 35 U.S.C. §112, first paragraph, Claims 1, 5, 8-9, 17 and 20 are rejected under 35 U.S.C. §112, second paragraph, Claims 1, 5, 8-9, 17 and 20 are rejected under 35 U.S.C. §102 and Claims 1, 5, 8-9, 17 and 20 are rejected under 35 U.S.C. §103. In response Claims 1 and 17 have been amended. This amendment does not add new matter. In view of the amendments and/or for the response set forth below, Applicants respectfully submit that the rejections should be withdrawn.

In the Office Action, Claims 1, 5, 8-9, 17 and 20 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. To satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention. An applicant shows possession of the claimed invention with all of its limitations using such descriptive means as words, structures, figures, diagrams, and formulas that fully set forth the claimed invention. There is no *in haec verba* requirement. Claim limitations can be supported through express, implicit or inherent disclosure.

Applicants respectfully disagree with the Patent Office regarding the written description requirement under 35 U.S.C. §112, first paragraph, because the Maillard reaction is a well known reaction to persons having ordinary skill in the art. The operating conditions necessary for the Maillard reaction to occur are also well known to persons having ordinary skill in the art.

The specification, at page 1, lines 23-26, discloses that, during roasting (of the cocoa beans), various chemical reactions occur such as Maillard-type reactions and thermal degradation reactions (e.g. decarboxylations, deaminations, oxidations, etc.). The Maillard reaction involving peptides, amino acids and reducing sugars generates compounds that are deemed to eventually contribute to the final cocoa/chocolate flavor. *Id.* The specification, at pages 1-2, further discloses that the identification of naturally occurring peptides is difficult and that several unsuccessful attempts have been made to artificially produce cocoa flavor. Although the

synthetic mixtures obtained are reminiscent of chocolate, they lack the body and the intensity of a typical chocolate flavor.

Presently, the currently available artificial chocolate flavors lack the desired intensity of chocolate aroma and an appropriate body. Consequently, a problem exists in that no processes are known for artificially producing chocolate flavor that has all components of a typical chocolate aroma and an appropriate body. The present invention now seeks to overcome this problem.

As detailed in the specification, during the extensive studies leading to the present invention, Applicants have surprisingly recognized that cocoa beans contain a variety of different peptides giving rise to a flavor not expected to occur in or be obtained from cocoa beans. In a first aspect, the present invention therefore pertains to flavor active compounds all derivable from cocoa beans and obtainable by subjecting one or more peptides selected from the group consisting of Arg-Phe, Ala-Glu, Glu-Ala, Val-Ala, Phe-Glu, Thr-Leu, Tyr-Val, Val-Tyr, Pro-Val, Asp-Ala, Ala-Asp, Trp-Ala, Ala-Asp, Trp-Ala, Phe-Ala, Ala-Phe, Tyr-Ala, Ala-Tyr, Lys-Glu, Lys-Phe, Val-Lys, Val-Phe, Leu-Leu, Met-Tyr to a Maillard reaction with reducing sugars.

Claim 1 has been amended to include, in part, a flavor active compound obtained by reacting one or more peptides selected from the group consisting of Arg-Phe, Ala-Glu, Glu-Ala, Val-Ala, Phe-Glu, Thr-Leu, Tyr-Val, Val-Tyr, Pro-Val, Asp-Ala, Ala-Asp, Trp-Ala, Ala-Asp, Trp-Ala, Phe-Ala, Ala-Phe, Tyr-Ala, Ala-Tyr, Lys-Glu, Lys-Phe, Val-Lys, Val-Phe, Leu-Leu, and Met-Tyr together and at least one reducing sugar to a Maillard reaction under conditions sufficient to form the flavor active compound. Claim 17 has been similarly amended. The amendments are fully supported in the specification.

Applicants respectfully submit that the specification reasonably conveys to one skilled in the art that the inventors, at the time the application was filed, had possession of the claimed invention. In other words, the specification provides clear teaching for a person having ordinary skill in the art to immediately understand which compounds would provide which specific flavors. For example, selected peptides are disclosed in the specification that provide chocolate, caramel and meat flavors. The specification, at page 3, discloses that according to a preferred embodiment, the present invention provides compounds obtainable by subjecting one or more peptides selected from the group consisting of Leu-Leu, Val-Tyr, Tyr-Val, Ala-Phe, Ala-Asp,

Val-Phe, Val-Lys, Leu-Leu or Val-Tyr to a Maillard reaction with reducing sugars, which compounds yield a chocolate flavor composed of a cocoa and/or caramel aroma. The specification, at page 3, also discloses that according to an alternative embodiment of the invention, the peptides are chosen from the group consisting of Leu-Leu, Val-Tyr, Tyr-Val, Ala-Phe or Ala-Asp, as these have been found to particularly yield an excellent aroma and an appropriate body. According to a preferred embodiment, the peptides which yield the best cocoa flavor are Val-Tyr, Tyr-Val, or Leu-Leu. In another embodiment, the peptides are chosen from the group consisting of Val-Phe or Val-Lys to provide a caramel flavor. According to yet another embodiment, the peptide to be subjected to the Maillard reaction is Met-Thr, as this has been found to yield an excellent and strong meat flavor. Further, Claim 13 discloses a bready flavor obtained by subjecting peptides selected from the group consisting of Phe-Val or Lys-Glu to the Maillard reaction with the reducing sugars under conditions sufficient to produce the bready flavor.

Further, in Example 1 the peptide model reaction gives detailed reaction conditions such as amounts, temperatures, pH and reaction time of 60 minutes. Sixty minutes was found to be a preferred time for the reaction. All of the dipeptides listed in Table 3 were tested and the olfactory evaluations are clearly shown. In the sensory profiling, it is clear that six reaction samples were prepared from the dipeptides Tyr-Val, Val-Tyr, Leu-Leu, Pro-Val, Val-Phe and Lys-Glu to which were attributed a good chocolate aroma. As a result, Applicants have provided more than a reasonable number of compounds and flavors to reasonably convey to one skilled in the art that the inventors, at the time the application was filed, had possession of the claimed invention. Based on at least these noted reasons, Applicants believe that Claims 1, 5, 8-9, 17 and 20 fully comply with 35 U.S.C. §112, first paragraph.

Accordingly, Applicants respectfully request that the rejections of Claims 1, 5, 8-9, 17 and 20 under 35 U.S.C. §112, first paragraph, be withdrawn with respect to the written description requirement.

In the Office Action, Claims 1, 5, 8-9, 17 and 20 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. Applicants respectfully submit that the amended claims, as described above, using the word "obtained" provides the proper clarity regarding the breadth of the claim. There is sufficient detail in the specification on the

isolation and the detection of peptides from the natural peptide pool. See, specification, pages 4-7. As discussed in the specification, at page 7, last paragraph, 36 dipeptides were investigated (see Table 3 where many of the different aroma profiles of reaction flavors were evaluated) and specification, at page 8, second paragraph, which discloses that a set of 11 peptide samples was selected for a large scale olfactory evaluation of which the dipeptides Val-Tyr and Tyr-Val clearly showed a balanced chocolate aroma. Further, as discussed previously, the specification describes peptides that give rise to compounds with chocolate, cocoa/caramel, cocoa, caramel, meat and bread flavors. As a result, Applicants respectfully disagree with the Patent Office's assertion that only one peptide has been subjected to a Maillard reaction. See, Office Action, page 10.

A large selection of suitable reducing sugars and solvents are disclosed at page 3, lines 20-24 and Claims 5 and 9 in the as-filed specification. Moreover, the peptide model reaction gives detailed reaction conditions such as amounts, temperatures, pH and reaction time of 60 minutes. In the sensory profiling, it is clear that six reaction samples were prepared from the dipeptides Tyr-Val, Val-Tyr, Leu-Leu, Pro-Val, Val-Phe and Lys-Glu all of which were attributed a good chocolate aroma. Thus, Applicants respectfully submit that the specification enables one having ordinary skill in the art to practice the claimed invention without undue experimentation. Based on at least these noted reasons, Applicants believe that Claims 1, 5, 8-9, 17 and 20 fully comply with 35 U.S.C. §112, first paragraph.

Accordingly, Applicants respectfully request that the rejections of Claims 1, 5, 8-9, 17 and 20 under 35 U.S.C. §112, first paragraph, be withdrawn with respect to the enablement requirement.

In the Office Action, Claims 1, 5, 8-9, 17 and 20 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. In response, Applicants respectfully submit that the amendments to independent Claims 1 and 17 as discussed above address the informalities cited by the Patent Office. For example, the term "obtainable" has been replaced by "obtained," and the term "subjected" has been replaced by "reacting." Applicants believe that the term "reducing sugars" is a well known term familiar and readily understandable to persons having ordinary skill in the relevant art. A large selection of suitable reducing sugars and

solvents are disclosed at page 3, lines 20-24 and Claims 5 and 9 of in the specification. Similarly, the expression “under conditions sufficient to form the flavor active compound” is also readily understood by a person having ordinary skill in the relevant art. The specification along with the claims specify what peptides to use, what reducing sugars are, and one having ordinary skill in the art would be familiar with the conditions necessary for a Maillard reaction to take place according to the claimed invention.

Further, the terms flavor, flavor active compound, aroma, taste, smell, body, etc., are used interchangeably in the specification because this is often case during general use. The expression “flavor active compound” generally means a compound, when added to a food product, that provides the desired aroma and taste to the food product (e.g. chocolate, where the aroma may be chocolate, cocoa, caramel, etc.). The flavor active compound is formed, as recited by the present claims, by reacting the peptide with a reducing sugar under Maillard reaction conditions.

Based on at least these noted reasons, Applicants believe that Claims 1, 5, 8-9, 17 and 20 fully comply with 35 U.S.C. §112, second paragraph.

Accordingly, Applicants respectfully request that the rejections of Claims 1, 5, 8-9, 17 and 20 under 35 U.S.C. §112, second paragraph, be withdrawn.

In the Office Action, Claims 1, 5 and 17 are rejected under 35 U.S.C. §102(b) as anticipated by Otagiri et al. (“*Otagiri*”), “Studies on a Model of Bitter Peptides...”. Applicants respectfully disagree with and traverse these rejections for at least the reasons set forth below.

Applicants have amended independent Claims 1 and 17 to include, in part, use the term “obtained” as discussed previously. In contrast, *Otagiri* fails to disclose or suggest a Maillard reaction as required by the present claims. For the reasons discussed above, Applicants respectfully submit that Claims 1, 5 and 17 are novel, nonobvious and distinguishable from *Otagiri*.

Accordingly, Applicants respectfully request that the rejection of Claims 1, 5 and 17 under 35 U.S.C. §102(b) be withdrawn.

In the Office Action, Claims 1, 5, 8-9, 17 and 20 are rejected under 35 U.S.C. §103 as being unpatentable over *Otagiri* in view of U.S. Patent No. 5,753,296 to Girsh (“*Girsh*”), or alternatively, in view of Oh (“*Oh*”), “Flavor Chemistry of the Maillard Reaction of Dipeptides.”

Applicants believe these rejections are improper and respectfully traverse them for at least the reasons set forth below.

Regarding *Otagiri* in view of Girsh, *Otagiri* discloses that Arg-Phe has a bitter taste. As admitted by the Patent Office, *Otagiri* fails to disclose that the flavor active compound is obtained by subjecting Arg-Phe to the Maillard reaction with reducing sugars. See, Office Action, page 13. The Patent Office alleges that because Girsh discloses that it is desirable to react cocoa powder protein (a bitter protein) with lactose to soften/sweeten the taste, it would be obvious to have utilized the Maillard reaction with the bitter dipeptide of *Otagiri* and a reducing sugar to soften the bitter compound (i.e. make it more palatable). However, Girsh teaches that the mixture is sweetened by the Maillard reaction. For instance, it converts the bitter taste of the dairy permeate/cocoa powder premix to a sweet taste making it more palatable so that less sweetener needs to be added to the final chocolate composition. See, Girsh, column 11, lines 36-58. As is well known, there are only four different types of taste sensations – bitter, sweet, sour and salty. Although the claimed invention uses the terms taste and flavor interchangeably, scientifically there is a distinction because the flavor includes a complex mixture of a myriad of tastes, aromas, etc., and not just a single taste such as bitter as described in *Otagiri* and sweet as described in Girsh. The present invention relates to the production of a complete chocolate flavor.

An object of the present invention is not to give a cocoa/chocolate product a sweeter taste, but rather to artificially produce a chocolate flavor. In any case, it is well known that the Maillard reaction contributes to the final cocoa/chocolate flavor during the processing of cocoa beans. This is detailed in the specification, at page 1, lines 14-26. In this respect, the Maillard reaction of cocoa powder protein with reducing sugars is well known to artificially produce a chocolate-like flavor as stated in the specification, at page 2, lines 1-9, which states “[s]everal attempts have been made to artificially produce cocoa flavor. One such attempt comprises subjecting acetone dried powder prepared from unfermented ripe cocoa beans to an autolysis at a pH of 5.2 followed by roasting in the presence of reducing sugars (Voigt et al., Food Chem. 49 (1994), 173-180). Mohr et al. report in Fette Seifen Anstriche 73 (1971), 515-521, about the isolation of a peptide fraction showing potential for chocolate flavor formation. Moreover, Voigt et al. report in several articles in Food Chem. 51 (1994), 7-14; 177-184; and 197-205, about the

production of a peptide-enriched pool of flavor precursors using purified storage proteins and endogenous cocoa proteolytic system, which precursors upon thermal reaction with reducing sugars resulted in a chocolate like flavor.”

Other methods of producing artificial chocolate are described at page 2, lines 10-25, but as stated, none have been successful, particularly in that it is difficult to obtain a clean and well-balanced chocolate flavor and/or the flavors obtained lack the desired body and intensity. As stated at page 2, lines 26-30, “[a]t present, the currently available artificial chocolate flavors lack the desired intensity of chocolate aroma and an appropriate body. Consequently, a problem exists in that no means are known for artificially producing chocolate flavor that has all components of a typical chocolate aroma and an appropriate body. The present invention now seeks to overcome this problem.”

In sum, *Otagiri* discloses that a peptide Arg-Phe has a bitter taste and Girsh disclose that cocoa powder has a bitter taste that may be made sweeter by a Maillard reaction of the cocoa powder protein and the lactose of the dairy permeate. As is well known in the art, cocoa powder contains many proteins, which are very large molecules that can be degraded into large numbers of smaller peptides and amino acids. It is clear that no combination of *Otagiri* and Girsh, which relate to bitter and sweet tastes, teaches or provides guidance to one having ordinary skill in the art that the limited number of specific selected peptides indicated in the present claims and a reducing sugar could be reacted under Maillard conditions to obtain a type chocolate flavor and an appropriate body. For the reasons discussed above, the combination of *Otagiri* in view of *Girsh* does not teach, suggest, or even disclose the claimed invention, and thus, fails to render the claimed subject matter obvious for at least these reasons.

Regarding *Otagiri* in view of *Oh*, *Otagiri* discloses that Arg-Phe has a bitter taste. As admitted by the Patent Office, *Otagiri* fails to disclose that the flavor active compound is obtained by subjecting Arg-Phe to the Maillard reaction with reducing sugars. See, Office Action, page 14. *Oh* states that dipeptides contribute to balance food aroma and that dipeptides and tripeptides are produced by thermal degradation during roasting. *Oh* states that certain peptides (Gly-Val, Gly-Leu and Ala-Ley-Gly) when reacted with fructose under Maillard conditions produce more pyrazines than respective amino acid mixtures. The Patent Office alleges that it would have been obvious to subject the dipeptide Arg-Phe of *Otagiri* to a Maillard

reaction with the reducing sugar fructose to obtain more pyrazines (i.e. aroma/flavor compounds).

Applicants respectfully point out that the peptides that are disclosed by *Oh* produce more pyrazines than respective amino acid mixtures when reacted with fructose under Maillard conditions (Gly-Val, Gly-Leu and Ala-Ley-Gly). All of these peptides are different to the peptides selected in the specification that give rise to the flavor active compounds of the claimed invention because none of the peptides in the claimed invention contain Gly. Thus, *Oh* actually teaches away from the claimed invention.

Moreover, *Oh* fails to disclose anything more than what has been stated in the specification, at page 1, lines 16-26, which reads, “[d]uring fermentation, the cocoa seed proteins are degraded by microbiological and enzymatic processes to yield mainly hydrophilic peptides and hydrophobic amino acids, which serve as flavor precursors for the unique chocolate flavor. The cocoa proteolytic system involved in these processes is highly efficient. The endogenous proteolytic activity in cocoa is represented by endoproteases, amino-peptidases and carboxypeptidases, which in concert have the capability to hydrolyze intact protein to single amino acids and oligopeptides of different length. During roasting, various chemical reactions occur, such as Maillard-type reactions and thermal degradation reactions (decarboxylations, deaminations, oxidations etc.). The Maillard reaction involving peptides, amino acids and reducing sugars generates compounds that are deemed to eventually contribute to the final cocoa/chocolate flavor.” However, an object of the present invention is to artificially produce a chocolate flavor from specifically selected peptides that has all of the components of a typical chocolate aroma and an appropriate body.

Other methods of producing artificial chocolate are described at page 2, lines 10-25, but as stated, none have been successful, particularly in that it is difficult to obtain a clean and well-balanced chocolate flavor and/or the flavors obtained lack the desired body and intensity. As stated at page 2, lines 26-30, “[a]t present, the currently available artificial chocolate flavors lack the desired intensity of chocolate aroma and an appropriate body. Consequently, a problem exists in that no means are known for artificially producing chocolate flavor that has all components of a typical chocolate aroma and an appropriate body. The present invention now seeks to overcome this problem.”



In sum, *Otagiri* discloses that a peptide Arg-Phe has a bitter taste and *Oh* teaches that certain peptides (Gly-Val, Gly-Leu and Ala-Ley-Gly) when reacted with fructose under Maillard condition produce more pyrazines than respective amino acid mixtures. *Otagiri* fails to disclose or suggest that a flavor active compound with a caramel/bready flavor is obtained by subjecting the bitter tasting Arg-Phe to the Maillard reaction with reducing sugars according to the present invention. *Oh* teaches away from the claimed invention by disclosing the reaction with fructose under Maillard conditions of peptides completely different from those of the claimed invention. For the reasons discussed above, the combination of *Otagiri* in view of *Oh* does not teach, suggest, or even disclose the claimed invention, and thus, fails to render the claimed subject matter obvious for at least these reasons.

Accordingly, Applicants respectfully request that the obviousness rejections with respect to Claims 1, 5, 8-9, 17 and 20 be reconsidered and the rejections be withdrawn.

For the foregoing reasons, Applicants respectfully request reconsideration of the above-identified patent application and earnestly solicit an early allowance of same.

Respectfully submitted,

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